RICE

SEARCH

- MST Program
  - Application
  - Courses
- ASTR502
- ASTR503
- ASTR530
- PHYS501
  - Requirements
  - Workshops
- Programs for Teachers
  - Needs Surveys
- Survey Results
  - Courses for Teachers
  - Online Courses
  - Mailing lists
- Rice Education Sites
  - Center for Education
  - K-12 Initiatives at Rice
  - Rice School Mathematics Project
  - Office of STEM Engagement
  - Teacher Education at Rice
- Links
  - Rice Physics & Astronomy
  - Rice Space Institute
  - Space Science Outreach [space.rice.edu]
  - The Public Connection [earth.rice.edu]

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ASTR 503 : ASTRONOMY FOR TEACHERS (CRN 23639)

DESCRIPTION | OVERVIEW | LEARNING GOALS | CLASS DETAILS | STANDARDS | SCHEDULE | HOMEWORK | OBSERVING

NEXT OFFERED Spring 2020: Offered by the Physics and Astronomy Department with cooperation from the Houston Museum of Natural Science.
The schedule updates frequently - for latest version of schedules, homeworks, etc please bookmark this page.

DESCRIPTION

Overview of stars, galaxies, and the Universe at a non-calculus level. Includes basics about the Sun. Learn how to teach astronomy concepts as specified by the state of Texas. Methods to help students master content, including lab activities suitable for K-12 classrooms and as field trips. Observing sessions at Rice campus observatory and George Observatory TBD. This course is designed for inservice and preservice science and math teachers (grades 6-12), but **is open to undergraduates considering a teaching profession (I will gladly approve special registration forms by paper or by esther.)**

OVERVIEW

This course is designed for inservice and preservice teachers who wish to improve their content skills in Astronomy. This course develops astronomy concepts in a manner consistent with National Science Standards, Texas Essential Knowledge and Skills proficiencies and HISD's Project Clear, and the new Texas High School Graduation requirements. The course (coupled with its partner course ASTR 502) covers all topics in the Texas High School Astronomy requirements, but will be taught at a level accessible for teachers in middle and upper elementary schools. It will also cover all relevant astronomy topics in the TX High School " Earth and Space Science" course.

The course also focuses on how students develop astronomy concepts and misconceptions and provides popular hands-on activities that can be used in the upper elementary and middle school grades (5-9) and also extended for high school Astronomy and Earth and Space Science. Participants use specially-developed software as part of the course and can involve their own students in many of the out-of-class activities. Main topics include the properties of light, celestial coordinates and the changes in the sky over a night and over a year; formation of stars, galaxies, and the universe; life and death of low and high-mass stars; extrasolar planets and astrobiology. The class is designed for inservice or preservice teachers. (Undergraduates considering teaching careers may take the class as part of their normal program; I will sign special registration forms for undergraduates.)

Skills Taught: Hands-on model making, direct observation of astronomical events, simulations, conducting experiments, reading and comparative analysis - all appropriate for replication in upper elementary and middle school classrooms. Use of observation, comparison, application, analysis, and synthesis. Mathematics at the level of algebra, logarithms, exponentials, trigonometry and sine waves. Training in "Space Update" and "Stellarium" software and experience in doing image processing and research on the Internet. Use of Powerpoint to create presentations. Observations at the Rice Observatory and one field trip TBD to the George Observatory.

Alignment with Texas Standards and High School Course requirements

SCIENCE TEKS

Grade Levels:	3-5 and 6-8
Strands:	Properties and Patterns; Tools and Equipment; Natural World; Systems; Matter and Energy Interactions; Scientific Processes; Inquiry; Critical Thinking

MATH TEKS

Grade Levels:	3-5 and 6-8
Strands:	Numbers, Operations, and Quantitative Reasoning: Measurement: Probability and Statistics

HIGH SCHOOL ASTRONOMY (TEXAS COURSE 112.48)

Knowledge and Skills:	Scientific Processes, scientific methods, use of data to make inferences
Science Concepts:	Characteristics of Galaxies, Age of the Universe, Big Bang Theory, Formation of galaxies and the solar system, Life cycles of stars, Nuclear reactions in stars, H-R Diagram, Units of measurement such as Light Year and Astronomical Unit; History of astronomy; Equation of gravitation, The Sun as a star, its energy sources (the remaining solar system concepts are covered in ASTR 502)

LEARNING GOALS

As a result of this class, the student will be able to:
1. describe and distinguish the various types of stellar and non-stellar objects: stars, galaxies, nebulae, red giants, planetary nebulae, supernovas, black holes, spiral galaxies, quasars, etc.
2. use the Herzsprung-Russell diagram to trace the Main Sequence and to show typical paths of stellar evolution.
3. use the Herzsprung-Russell diagram to determine rough ages of stellar clusters
4. use trigonometry to explain how parallax works, and calculate parallax of various objects.
5. describe the "distance ladder" and how astronomers can calculate distances to very distant objects..
6. use Hubble's law to calculate velocity from distance or vice versa.
7. understand the electromagnetic spectrum and identify common atomic lines.
8. observe and sketch stars, clusters, and galaxies in the sky and (Communication) be able to demonstrate to others.
9. distinguish between "dark matter" and "dark energy".
10. (Communication) research a NASA astrophysics mission, and make a powerpoint presentation to class.

CLASS DETAILS

Meeting times	Monday evenings, 6 - 9 pm (plus a few Thursdays and two Friday observing session) January 13 through April 24, 2020
Meeting location	HBH 223, with some sessions in the campus planetarium BRK250, plus labs at the Campus Observatory (BRK 400) and George Observatory
Instructors	Prof. Patricia Reiff (reiff@rice.edu); Phone 713-348-4634; Office HBH 226; Office Hours by Appointment Adjunct Prof. Carolyn Sumners (csumners@hmns.org)
Textbooks	"Astronomy" by OpenStax "Space Update", SpaceUpdate.com, ISBN 9781931-523530 (available from instructor); Bring laptop to class
Syllabus, Homework, and Grading	Grading: approximately 40% for two quizzes; 50% for homework; 10% for observing project; no final exam. One of the homeworks will involve researching a spacecraft or ground-based Astronomy mission and making a Powerpoint or wikipedia page and presenting to the class. Schedule | Homework
University Credit Hours	3 (sorry, no stipend) To register for credit, contact Patricia Reiff (reiff@rice.edu) at 713-348-4634. You must be registered as a "Visiting" graduate student or be in the Master of Science Teaching program. (Visiting Student registration materials will be available at the first class). Undergraduate students considering a teaching career are also encouraged to enroll in this class for credit, but it may not count as an upper-division elective for a BS in Astrophysics.
Tuition/fees	Courtesy of major discounts from Rice University, the tuition is only $1200 for three hours of graduate credit for inservice teachers, plus $150 fees. Certain inservice teachers may qualify for special tuition scholarships - come to class the first evening.
Absence Policy	The lectures will be recorded for later playback through zoom. Because of the intense hands-on nature of some of the sessions, and the fact that we will observe through the campus telescope if weather permits, students should try to attend every class but no specific penalty for absences.

	Remote participation by Zoom available.
Honor Code	Students may work together on homework but each student shall turn in their own paper. Quizzes must be pledged as individual work and are subject to the Rice Honor Code.
Students With Disabilities	Any student with a disability that requires accommodation should contact the instructor and the Disability Support Servies. We will attempt every reasonable accommodation.

SCHEDULE : SPRING 2020 (tentative)

DATE	MATERIAL
Mon Jan 13 HBH 223 (6-9 pm)	Class overview; filling out of forms; installation of Space Update software; Overview of the Universe; Overview of the Galaxy (**BRING A LAPTOP**)
Mon Jan 20	NO CLASS DUE TO MLK DAY
Mon Jan 27 HBH 223 (6-9 pm)	Introduction to Celestial coordinates; Motion of the Sky through the night; Changes during the year; changes from changes in latitude or location
Jan 31 (if clear) 6 - 10 pm (Backup Date Feb 1)	OBSERVING at Rice University Campus Observatory
Mon Feb 3 BRK 250 (6-9 pm)	The sky in the planetarium dome: celestial coordinates, motion of the sky at night
Mon Feb 10 HBH 223 (6-9 pm)	Properties of Light; spectroscopy; doppler shift; Universe in various wavelengths; introduction to parallax
Mon Feb 17 HBH 223 (6-9 pm)	Calculations of distances using parallax and standard candles. Small-angle trigonometry. Activity: size and distance of the Moon
Mon Feb 24 HBH 223 (6-9 pm)	Cosmology and the Expansion of the Universe; "Missing Mass"
Mon Mar 2 HBH 223 (6-9 pm)	Review for Quiz 1; (takehome Quiz 1)
Mon March 9 HBH 223 (6-9 pm)	Birth and Life of Stars; H-R Diagram
Mon March 16 HBH 223 (6-9 pm)	NO CLASS - SPRING BREAK
Mon March 23	More on Stars: Fusion, Corona, Solar flares
TBD (if clear) 7 -10 pm (Backup Date TBD)	OBSERVING at George Observatory, Brazos Bend State Park (no overnight)
Mon March 30	Death of Stars: red giants, planetary nebulae, white dwarfs
Mon April 6	Search for Extrasolar planetary systems
Mon April 13	Supernovas, neutron stars, Black Holes, wormholes and other exotic topics
Mon April 20	Class presentations, review for Quiz 2 (takehome quiz)

HOMEWORK

- **Homework 1**: Stellarium activity.
- **Homework 2**: Doppler shift activity
- **Homework 3**: Distances and magnitudes activity - distances to stars, etc.
- **Homework 4**: Properties of Light activity.
- **Homework 5**: Sun and Stars homework
- **Homework 6**: Observing Project.
- **Homework 7**: Public Education Project.

- **Homework 8**: Astronomy Mission Report (counts as 12 points, including presentation). Electronic version of powerpoint or wikipedia file must be turned in, including movies if used. Must include at least 6 references, of which at least one must be a print, refereed, scientific journal (not just a web reference). Presentations April 20.

DOWNLOADS

- Quiz 1 review sheet (not yet updated for 2020)
- Quiz 2 review sheet (Not yet updated for 2018)
- Topics, Terms and Formulas (Not yet updated for 2018)

OBSERVING PROJECT (homework 6)

There will be at least four evening observing sessions, but we get clouded out a lot, so be sure to come to the first possible session you can! Come to Rice "Open Houses" each month as well. Or, you can go the "George Observatory" (in Brazos Bend State Park) any clear Saturday evening. (We may do a campout, date TBD)

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